ADMIN RECORD COPY

June 16, 2000

To: Norma Castaneda, DOE/RFFO, x4226

From: Tracey Spence, RMRS, x4322

Subject: Proposed Design Change for 881 Hillside French Drain Outfall Pipe

As per your request, possible design changes for the French Drain decommissioning pipeline follow.

The existing design calls for the French Drain outfall pipe to extend from the South Interceptor Ditch (SID) north side-wall as illustrated on the attached Drawing No. 38548-0150. As designed, the pipeline would be installed in gravel with a geotextile liner and groundwater collected in the French Drain sump would discharge from the outfall pipe directly into the existing riprap embedment of the SID. Please note that the average flow from the pipeline is anticipated to be less than ½-gallon per minute with less than 1-gallon per minute during peak flow.

In order to address the concern with the outfall pipe being exposed in the SID on a long-term basis, it is proposed that the outfall end of the pipe be covered with riprap and/or gravel such that it is still accessible but not exposed at the surface. This would require minimal design change and minimal increase in cost, if any. Operation and flow from the pipeline could still be monitored and, if necessary, sampled and/or serviced. The outfall would appear as a small seep at the SID north side wall.

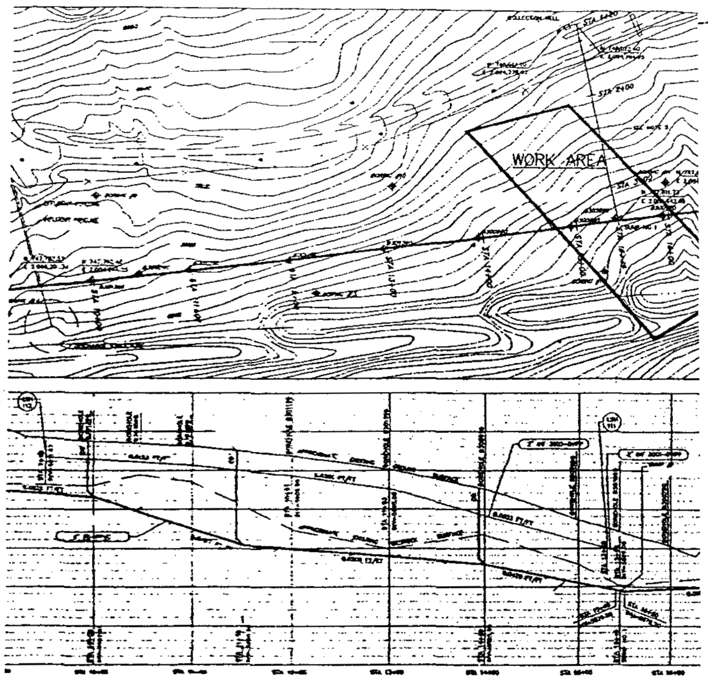
It is possible to install a shorter length of pipe so the outfall end of the pipeline would remain underground (see changes on drawing in red ink). As such, groundwater would discharge into the lined gravel and riprap embedment and then seep into the SID from the north side wall. This design will require further evaluation to determine long-term effects and impacts on the hillside in the event of peak flow. This configuration would make monitoring the pipeline for satisfactory flow difficult. The outfall would still appear as a seep at the SID north side wall. In the event the SID is remediated in the future, the pipeline location may not be known if it's buried in the side wall.

Also, as requested, attached to this memo is a copy of the Analysis of OU 1 881 Hillside French Drain Decommissioning Alternatives evaluated by RMRS in January 1998.

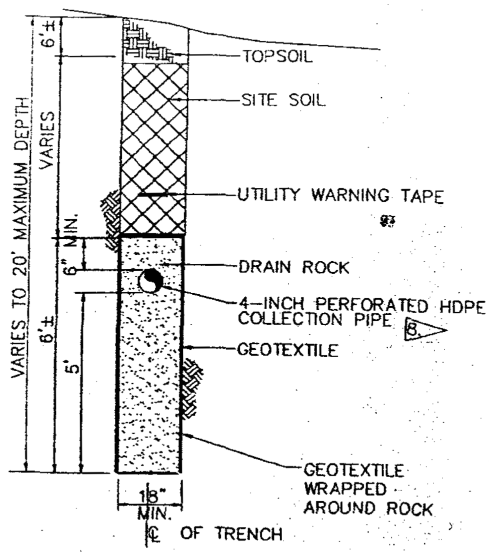
Cc Lane Butler
Annette Primrose
Diana Woods

Y/12

PART	QUAN.	DESCRIPTION	MATERIAL



FRENCH DRAIN PLAN AND PROFILE
SCALE 1"= 100'



B OUTFALL DITCH CROSS-SECTION
NOT TO SCALE

Consider terminating pi
3 feet of South Interc
sidewall.

NOTES:
1. COORDINATES SHOWN ARE STATE PLANE SYSTEM. SEE DRAWING 38548-X030 FOR CONTROL POINTS.

2. SEE ALL PROJECT DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL DETAILS.

3. ALL WELLS ARE TO REMAIN IN PLACE EXCEPT AS NOTED.

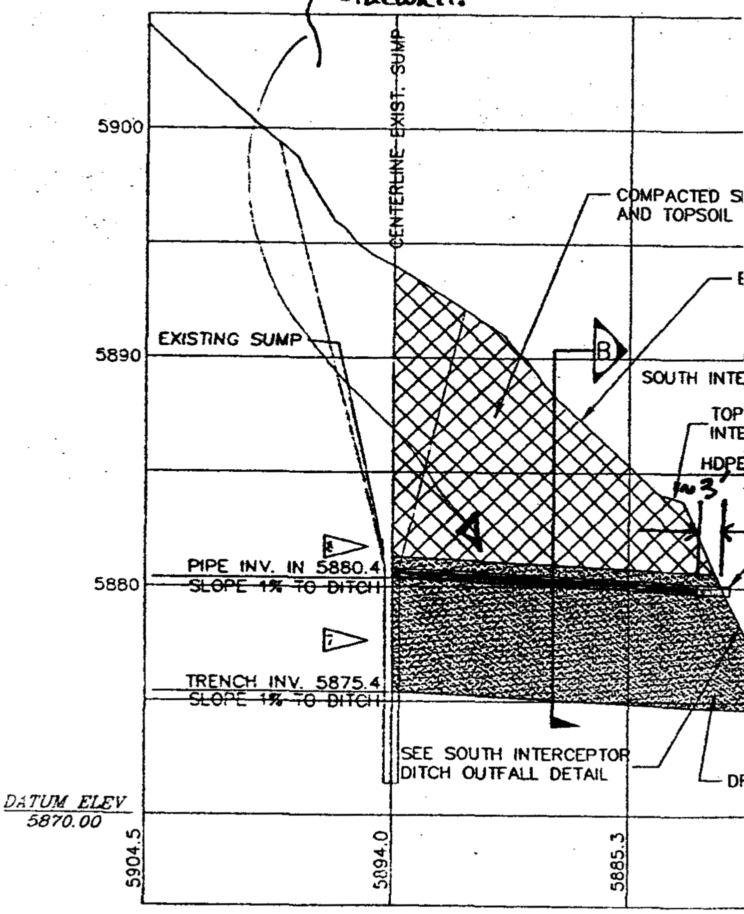
4. SUBCONTRACTOR SHALL STAY WITHIN CONSTRUCTION LIMITS SHOWN AND SHALL INSTALL SILT FENCE AROUND PERIMETER OF CONSTRUCTION AREA. SUBCONTRACTOR SHALL INSTALL HAY BALE BARRIER IN SOUTH INTERCEPTOR DITCH TO PREVENT SEDIMENT FROM CONSTRUCTION AREA FROM TRANSPORTING DOWN DITCH.

5. ALL EXCAVATED SOIL SHALL REMAIN WITHIN THE SILT FENCED AREA DURING CONSTRUCTION, AND SHALL BE SPREAD WITHIN THE CONSTRUCTION AREA UPON COMPLETION OF CONSTRUCTION.

6. ALL DISTURBED AREAS SHALL BE REVEGETATED IN ACCORDANCE WITH PROJECT SPECIFICATIONS.

7. GEOTEXTILE SHALL BE INSTALLED AROUND ALL DRAIN ROCK AND AT ALL INTERFACES BETWEEN NEW DRAIN TRENCH AND EXISTING SUMP MATERIALS. WRAP NEW GEOTEXTILE AROUND NEW/OLD GEOTEXTILE INTERFACES TO ENSURE CONTINUOUS GEOTEXTILE COVERAGE BETWEEN SUMP/TRENCH INTERFACE.

8. HDPE SLOTTED PIPE SHALL BE PROVIDED WITH A FILTER SOCK ALONG ENTIRE LENGTH AND ACCROSS INLET END.



A OUTFALL TRENCH SECTION
SCALE: HORIZ. 1"= 20'
VERT. 1"= 4'

	ORIGINAL ISSUE DESCRIPTION			J30FDR00 PROJECT/WCF NO
TOLERANCES	DESIGN COMPANY: RMRS			U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO
FRACT. ± –	DESIGNED BY DK WOODS	DW	5/4/00	Rocky Flats Environmental Technology Site GOLDEN, COLORADO
ANGLE ± –	DRAWN BY DK WOODS	DW	5/4/00	
DEC. ± –	CHECKED BY D WEINGARDT	DW	5-4-00	DECOMMISSION OU1 881 HILLSIDE AREA FRENCH DRAIN
UNLESS NOTED OTHERWISE	APPROVED BY Hampton, T		5/4/00	OUTFALL TRENCH SITE PLAN AND SECTIONS
REMOVE BURRS AND SHARP EDGES				
NEXT ASSEMBLY	CLASSIFIER D WEINGARDT	DW	5-4-00	SIZE D · DRAWING NUMBER 38548-0150 · ISSUE 0
SCALE: NOTED	LANDLORD TRACEY SPENCE		5/10/00	

Best Available Copy

2

Analysis of
OU 1 881 Hillside
French Drain Decommissioning
Alternatives

January 29, 1998

3

1.0 INTRODUCTION

The objective of this evaluation is to analyze different options for decommissioning the French Drain at the 881 Hillside. The French Drain is part of an Interim Measure/Interim Remedial Action to address groundwater as part of the remediation of Operable Unit 1 (OU 1).

The French Drain was constructed between November 1991 and April 1992. The French Drain is 1,435 feet long and has a single sump at its lowest elevation. The French Drain was constructed by excavating a "V " shaped trench two feet into competent bedrock. Due to contours in the bedrock, a number of low points exist along the length of the French Drain. A polyvinyl chloride liner was placed on the downstream wall of the drain. A drain pipe and gravel was placed in the bottom of the drain and then covered with structural fill. Groundwater collected by the French Drain is pumped through a pipe near the top of the drain to the Building 891 Consolidated Water Treatment Facility (CWTF). After treatment the water is discharged to the South Interceptor Ditch (SID).

Decommissioning of the French Drain is part of the final remedy for closure of this operable unit. On October 29, 1997, a meeting was conducted between the Department of Energy, the Colorado Department of Public Health and Environment, the Environmental Protection Agency, Kaiser-Hill, and Rocky Mountain Remediation Services. As an outcome of that meeting, it was decided that an evaluation would be prepared focusing on passive draining techniques for the French Drain and emphasizing the capability to restore the French Drain to an operational state.

Ten different alternatives were analyzed for decommissioning of the French Drain. Alternatives were evaluated based on their advantages, disadvantages and cost. The emphasis of the evaluation was placed on passitivity, durability, length of operation, cost, reversibility, erosional impacts, and impacts to slope stability.

2.0 DESCRIPTION OF FRENCH DRAIN DECOMMISSIONING ALTERNATIVES

The alternatives are grouped by whether they utilize mechanical means of continued operation (non-passive) or through gravity flow (passive) and whether the trench integrity is lost (destructive) or retained (non-destructive).

Non-Passive/Non-Destructive

1) **Bypass Treatment System** - Under this alternative no physical modifications would be made to the French Drain or the CWTF. Water would be collected and pumped to bypass portions of the treatment system and then discharged through the effluent line. Although a cost savings would be realized by eliminating some or all of treatment, because of the current configuration of the treatment system, operations would be hampered since the water would ~~have~~ still pass through portions of the system and the influent and effluent tanks would have to be utilized. It is possible that some treatment of the water could occur if the water had to be forced through the ion exchange system in order to utilize the effluent tanks as a discharge point. This alternative provides a short-term solution since it is viable only as long as the treatment system is in use.

2) **Pump to Effluent Line** - This alternative consists of installing a connecting line between the Building 891 CWTF influent and effluent lines. This line would be installed in the utility trench west of the French Drain. Valves added to the influent line and the connecting line would allow water to be redirected to either the effluent line or the Building 891 CWTF, if needed.

3) **Pump to South Interceptor Ditch** - This alternative consists of installing an underground line from the top of the French Drain to the SID. This line would be trenched across the top of the French Drain so as to cause minimal impact to the integrity of the drain and to protect against freezing. Additionally, the line would be valved so that water could be pumped to the treatment system should the need arise. Modifications to the SID, such as laying down rip rap and/or making a spill way, would probably be necessary to reduce soil erosion and to maintain the integrity of the SID. An additional alternative would be to pump the water directly to Woman Creek.

<u>Passive/Non- Destructive</u>

4) **Gravity Flow to the South Interceptor Ditch** - This alternative consists of installing an underground line from the top of the French Drain sump to the SID. Installation of the line would require breaching the French Drain; however, resealing the south French Drain wall by replacing the geomembrane around pipe would result in minimal impact to the integrity of the French Drain. The line would be valved so that water could be pumped to the treatment system should the need arise. Modifications to the SID such as laying down rip rap and/or making a spill way would be necessary to reduce soil erosion and to maintain the integrity of the SID. An additional alternative would be to install a gravity flow line directly to Woman Creek. Another variation of this alternative would be to construct a ditch instead of using underground piping to discharge to a surface water system.

5) **Gravity Flow To Colluvium (Leach Field)** - A gravity flow system similar to the system described under Alternative 4 would be constructed; however, instead of discharging to surface water, the water would discharge to a leach field constructed in the colluvium. The colluvium actually extends beneath the SID and Woman Creek ; however, the colluvium is not very thick and the water could daylight as a seep. Wetlands creation could potentially be avoided through the construction of a clay cap over the leach field.

6) **Breach Drain With Trenches Containing Perforated Pipe** - This alternative consists of breaching the French Drain across approximately five locations and laying perforated pipe from the French Drain to topsoil on the south side. This alternative offers the advantage over using trenches alone since the breach in the French Drain could be sealed with a geomembrane around the pipe to minimize the impact to integrity of the drain. Valving or by grouting the pipe could restore the French Drain to operation. The perforated pipe would allow water to be introduced into the aquifer over a wider area.

7) **Breach Trench At Sump And Create Wetlands Area Between SID and French Drain** - A gravity flow system similar to the system in Alternatives 4 and 5 could be constructed. Water from the pipe would discharge to an artificially created wetland rather than flow directly to the SID. This alternative could provide some natural water remediation through

5

biological degradation and settling of colloidal radionuclides; although concentrations in the water are already below discharge requirements. It could possibly provide a wetlands credit under the Clean Water Act for the Department of Energy. As site closure proceeds, the volumetric flow rate to a wetlands area could be reduced due to the elimination of leaks in sewer and water lines.

8) **Breach Trench at Sump And Construct A Passive Weir Treatment System -** A gravity flow system similar to the system in Alternatives 4, 5, and 7 could be constructed that would discharge to a multiple weir system. This system would have the advantage of providing some water treatment capabilities and preventing soil erosion. A series of concrete weirs could be constructed between a French Drain outlet and the SID. Because of the lack of elevation between these points, the weir system is proposed to run a 100 extra feet parallel to the SID. An alternative to a passive weir system is a passive air stripper to remove volatile organic compounds (VOCs) ; however, there is not a sufficient grade between the discharge of the French Drain and the eventual outfall in the SID or Woman Creek.

9) **Breach Drain With Angled Boreholes -** Three or four boreholes with slotted screen would be placed at approximately five locations along the length of the French Drain. The holes would be targeted at just above or below the soil/bedrock contact. To reactivate the drain, the holes would be sealed by filling them with grout. A variation of this alternative would be to fill the holes with a sand slurry and cap the top with grout. Restoration of the French Drain under this variation would take significantly more work and so this variation was not pursued farther.

Passive/Destructive

10) **Breach Drain With Trenches -** Approximately four trenches would be cut into the drain at low points. Gravel would be poured into the trenches or existing gravel from the French Drain would be pulled down into the trench as it is being excavated. Due to the geology of the hillside, water passing through these trenches would not infiltrate very deep and would daylight as a seep a short distance down the hillside. Power and control lines for the pump in the French drain sump are likely to be disrupted in this process. Restoring the drain under this alternative would be very difficult.

3.0 ANALYSIS OF ALTERNATIVES

The advantages and disadvantages of the ten alternatives were analyzed and the results are summarized in Table 3-1. All of the advantages were evaluated in terms of permanence and the ability to maintain the integrity of the French Drain; however, it should be noted that regardless of the alternative, erosion, slumping, and other natural forces will, with time, impact any of the alternatives and the viability of re-utilizing the French Drain. Cost estimates for each alternative presented in Table 3-2 are rough order-of magnitude. For alternatives requiring maintenance, it was assumed that maintenance was continued for ten years.

Alternatives 1-3 (Non- Passive/Non- Destructive) require continued operation of the pump in the French Drain. These alternatives are considered short-term actions and would require a follow on action to complete the decommission the French Drain. As a result, these alternatives are

6

Table 3-1: Comparison of French Drain Decommissioning Alternatives

Decommissioning Alternative	Advantages	Disadvantages
Non- Passive/Non- Destructive		
1) Bypass Treatment System	• No capital cost • No impacts to environment • Water can be treated if need be • French Drain remains completely intact • No stability issues	• Short-term solution • Continued operating costs • Treatment system operations would be hampered
2) Pump to Effluent Line	• Easy to restore flow to treatment system • Low initial cost • French Drain remains completely intact • No stability issues	• Continued operating Cost • Pump would have to be maintained indefinitely • Short-term solution
3) Pump to South Interceptor Ditch	• Easy to restore flow to treatment system • Low initial cost • Minimal impact to French Drain. • No stability issues	• Continued operating cost • Pump would have to be maintained indefinitely • Short-term solution • Spillway or soil erosion protection would be needed
Passive/Non - Destructive		
4) Gravity Flow to the South Interceptor Ditch	• Low maintenance requirements • Long-term solution • French Drain could be easily restored	• Spillway or soil erosion protection would be needed • French Drain would have to be breached • Freeze protection might be necessary • Shifting of the trench could cause drainage problems

7

Table 3-1: Comparison of French Drain Decommissioning Alternatives

Decommissioning Alternative	Advantages	Disadvantages
5) Gravity Flow To Colluvium (Leach Field)	• Low maintenance requirements • Long-term solution • French Drain could be easily restored	• Potential slope stability problems • French Drain would have to be breached • Leach field functioning would be hampered by clay and shallow depth of topsoil and colluvium • Shifting of the trench could cause drainage problems
6) Breach Drain With Trenches Containing Perforated Pipe	• Water discharge is spread out more • Potentially less erosion protection measures • French Drain could be restored to operation • Long-term solution • Low maintenance	• Potential slope stability problems • Additional cost of sealing around pipe • Potential drainage and erosion problems • French Drain would have to be breached • Possible disruption of pump control and power lines in the French Drain
7) Breach Trench At Sump And Create Wetlands Area	• French Drain could be restored to operation • Long-term solution • Low maintenance • Wetlands credit • Reduction of contaminants through natural processes	• Additional cost of wetlands construction • French Drain would have to be breached • Saturated soil could cause shifting of the trench
8) Breach Trench at Sump And Construct A Passive Weir Treatment System	• French Drain could be restored to operation • Long-term solution • Low maintenance • Some contaminants would be removed	• Additional cost of constructing weir • French Drain would have to be breached • Shifting of the trench could cause drainage problems

8

Table 3-1: Comparison of French Drain Decommissioning Alternatives

Decommissioning Alternative	Advantages	Disadvantages
9) Breach Drain With Angled Boreholes	• French Drain could be restored to operation • Long-term solution • Low maintenance • Minimal disturbance to hillside	• Some ponding could occur within the drain • Potential drainage and erosion problems • Potential slope stability problems
Passive/Destructive		
10)Breach Drain With Trenches	• Drain is fully decommissioned	• Possible disruption of utilities in drain • Difficult to restore drain to operations • Hillside stability could be disturbed • Water discharge would not be spread along length of drain • Potential drainage and erosion problems

9

Table 3-2: Comparison of Costs for French Drain Decommissioning Alternatives

Decommissioning Alternative	Cost
Non- Passive/Non- Destructive	
1) Bypass Treatment System	$48,000
2) Pump to Effluent Line	$89,000
3) Pump to South Interceptor Ditch	$70,000
Passive/Non - Destructive	
4) Gravity Flow to South Interceptor Ditch	$78,000
5) Gravity Flow To Colluvium (Leach Field)	$81,000
6) Breach Drain With Trenches Containing a Slotted Screen	$103,000
7) Breach Trench At Sump And Create Wetlands Area	$77,000
8) Breach Trench at Sump And Construct A Passive Weir Treatment System	$84,000
9) Breach Drain With Angled Boreholes	$150,000
Passive/Destructive	
10)Breach Drain With Trenches	$76,000

* These alternatives are for a project life of 10 years after which additional costs would be incurred to completely decommission the French Drain. These additional costs would significantly increase the total cost of these alternatives.

10

more expensive over the long-term than the other alternatives presented. The cost estimates for Alternatives 1-3 presented in Table 3-2 are for only ten years of operation and do not include any follow on decommissioning activities. Also, Alternative 1 gives the appearance of being simpler to implement than it would be in reality since it would tie up portions of the treatment system.

The Passive/Non-Destructive Alternatives (Alternatives 4 through 9) better meet the objective of draining the French Drain while allowing the reversal of the decommissioning process. The geometry of the French Drain relative to the SID and Woman Creek plays a crucial role in the evaluation of these alternatives. The French Drain is at the base of the 881 Hillside resulting in a very small difference in elevation between the base of the French Drain and the SID. The French Drain was cut deep into this hillside so that it penetrated the bed rock by about two feet. Because of these conditions, the bottom of the western portion of the French Drain (about 1,045 feet) from the western end to the sump is between one and eighteen feet lower than the bottom of the SID. As a result, water in the western section will preferentially flow towards the sump rather than through breaches in the drain. The slope is such that it would not be feasible to allow water to back up in the drain to force it towards other outlets. In the eastern third of the drain there is sufficient elevation to allow flow to the SID or Woman Creek; however, there are greater distances between the drain and the SID and this is a smaller portion of the total flow.

Flow from the sump to the SID as described in Alternative 4 is possible because there is a drop off in the SID which yields enough of an elevation difference to adequately induce flow. Gravity flow would take the water away from the drain resulting in better slope stability. Additionally, it would discharge to area that already has rip rap so that erosional impacts would be minimal.

The underlying geology in the French Drain area would make the leach field, described in Alternative 5, ineffective. The leach field would be placed in the upper layer of colluvium which is about ten feet thick. The presence of claystone and siltstone beneath the more permeable colluvium might cause the water to mound and daylight rather than infiltrate into lower strata. A possible outcome of a leach field would be a large seep that would likely cause erosion and undermine the stability of the slope around the center of the French Drain.

Breaching the drain with trenches with perforated pipe (Alternative 6), angled boreholes (Alternative 9), or trenches alone (Alternative 10) would be ineffective since most of flow would come out of the trench closest to the sump while the other trenches would be fairly dry. Like Alternative 5, these alternatives might create a seep in an area that could destabilize the French Drain and the hillside and cause erosion and possibly ponding.. ✓

Creating a wetlands (Alternative 7) would have some benefits. Although contaminant levels are not of concern, some remediation of organic compounds and radionuclides would occur if they were present. The DOE could also get some wetlands credit under the Clean Water Act; however, the wetlands would require excavation into the base of the hillside, instabilities could arise resulting in slumping and potential impacts to the integrity of the French Drain.

A passive treatment system based on a series of weirs (Alternative 8) suffers from the same lack of elevation as many of the other alternatives. Because there is little elevation difference, only a few weirs could be used between the sump and the nearest feasible point in the SID. To alleviate this problem the weirs could be set parallel to the SID for about 100 more feet. This allows more weirs and as a result greater area of interface between the water and the ambient air. Although not present above levels of concern, this alternative would strip the water of some

VOCs. It would also contain the water and as a result reduce erosion and the potential for slumping along the base of the hill.

4.0 RECOMMENDATIONS

The recommended method for decommissioning the French Drain is run a simple pipeline from the French Drain Sump to the SID (Alternative 4 - Gravity Flow to SID) . This option has the following advantages:

- Simple design,
- Easily implementable and reversible,
- Cost effective,
- Low-maintenance,
- Drains the French Drain at its lowest elevation,
- Minimal erosional impacts,
- Minimal impact to slope stability,
- Passive system, and
- Long-term solution.

A second recommended design is Alternative 8, the passive weir system. It would also get the water away from the hillside without inducing slumping.

12/12